Ecological Restoration Assessment & Monitoring

Poster Session Abstracts

Update on a Framework for Stream Bioassessment in the Nontidal Potomac

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ABSTRACT: The Interstate Commission on the Potomac River Basin (ICPRB) is working to integrate biological monitoring data collected by the Basin jurisdictions (MD, PA, VA, WV) to produce composite indexes of ecosystem health in non-tidal Potomac waters. Issues and challenges encountered during the ongoing assessment framework development process will be presented, as well as future prospects for the resulting composite index. The index will ultimately provide integrated, quantitative information on the chemical, physical, and biological integrity of aquatic habitat in the non-tidal Potomac that is consistent across state boundaries, facilitating whole-watershed and interstate perspectives.

The National Aquarium in Baltimore's Use of Publicly Accessible Water Quality Data as an Education Tool

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ABSTRACT: The National Aquarium in Baltimore (Aquarium) is using the educational power of the Internet and GIS (geographic information systems) to inspire interest in local watersheds and teach the public how everyday actions can impact the environment several miles away. Visitors to the Aquarium's website are able to locate the watershed in which they live, discover why a healthy watershed is important, learn what factors affect water quality, and download real-time water quality data collected from a field station at the mouth of the Patapsco River near Baltimore Harbor, Maryland. Every 15 minutes, a Yellow Springs Instruments model 6600 sonde, suspended in the water column, records water temperature, dissolved oxygen, salinity, pH, turbidity, and chlorophyll concentration. At the same time interval, a nearby Campbell Scientific weather station measures air temperature, relative humidity, wind speed and direction, rainfall, photosynthetically active radiation, and atmospheric pressure. This data is uploaded to the Aquarium's website, where viewers are able to see how both weather events and man-made causes can alter water quality, thereby affecting the plants and animals that live in and near the Chesapeake Bay. GIS technology is being used to creatively present and interpret these data as well as integrate other environmental information. For those without Internet access, we have produced

a CD-ROM, Living Waters of the Chesapeake that contains similar information. This is particularly important since targeted users include urban schools that currently lack Internet access. By communicating watershed dynamics and connecting with communities, we aim to inspire stewardship and environmental leadership.

Charles County Watershed Prioritization

Ian Botts (GIS Analyst), Michael Pieper (Senior Environmental Scientist), Nathan Drescher (GIS Analyst), William Frost, PE (Senior Watershed Planner), KCI Technologies, Inc., MD 21030, (410) 316-7808

ABSTRACT: Charles County, Maryland was issued its second 5-year stormwater NPDES permit in July 2002. One of the requirements in the permit is to use the data gathered as a result of prior NPDES activities to prioritize all watersheds within Charles County in the context of water quality.

This work was recently completed by Charles County and its consultant, KCI Technologies, using a GIS-based analysis of restoration needs for the County's watersheds, based on the Maryland DNR 12-digit watershed segmentation.

Prioritization was determined utilizing a weighted model employing the raster data capabilities of ESRI'S Spatial Analyst extension to ArcView. This model was built using available GIS data from a variety of sources. The most relevant GIS data in determining watershed prioritization were:

DNR Wetlands
Wetlands of Special State Concern
Census Blocks
Forest Cover
Modeled TN Loads
Modeled TP Loads
Modeled Zn Loads
Modeled TSS Loads
Land Use
Impervious Surfaces
Riparian Zones
Critical Areas

Each vector data layer was converted to a raster grid utilizing Spatial Analyst and a weighting system was then applied to produce a map showing watershed conditions. A weighting factor was applied to each grid based upon how well it discriminated between areas of high and low quality. The weighted grids were then added together utilizing the raster utilities in Spatial Analyst to produce a composite raster representing areas of potential watershed impact.

The result is a ranking of Charles County's watersheds showing which are in most need of restoration, and which have the highest priority for preservation. The work is currently being used to identify areas where additional monitoring will be conducted in support of potential restoration projects.

Comparability of Benthic Macroinvertebrate Multihabitat Sampling

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ABSTRACT: Documentation of data quality characteristics is necessary to understand the confidence with which biological assessment data from multiple sources can be compared or combined into larger datasets. We evaluate the comparability of three benthic multihabitat sampling methods, that varied in their approaches for allocating sampling effort among habitats, using three performance characteristics: 1) sensitivity, 2) repeateability, and 3) comparability. Each method was used to sample the same 11 sites in and around Rockdale County, Georgia. Method sensitivity assessed the ability of method-specific multimetric index scores to reflect impairment, as defined *a priori*. Comparability was represented by among-method precision, which described the ability of different methods to produce results similar to one another. Duplicate sample data collected from an adjacent reach, and using the same method as at the original reach, were used for evaluating within-method precision, which described the ability of each method to reproduce results (repeatability). Results showed that within- and among-method precision were relatively similar to one another suggesting that differences in the allocation of sampling effort among habitats did not dramatically affect final assessments. Accuracy was difficult to fully evaluate because of the limited number of reference and stressor sites; however, all the methods were able to detect impairment as represented by high discrimination efficiencies. Our results lend support to combining or comparing large datasets from multihabitat sampling if other aspects of data quality are controlled.

Accessing Vegetative Factors Before and After Stream Restoration

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ABSTRACT: Since the summer of 2001, the Maryland Department of Natural Resources (MD DNR) and the Maryland Department of Transportation (MDOT) have joined in an inter-agency effort to assist existing State and local partnerships in an effort to protect and restore streams historically subjected to degradation by highway construction and runoff. The goal of the program is to restore in-stream fish and wildlife habitat in targeted areas. This joint effort is known as the Governor's Watershed Revitalization Partnership. MD DNR and MDOT are funding this effort through a portion of the 1998 Transportation Equity Act for the 21st Century (TEA-21).

Projects were selected based on local stream characteristics and project goals such as: mitigation of impacts from roads and bridges, reduction of nutrients and sediment, reduction of stream bank erosion, enhancement of the quality of life of communities, and the revitalization of community open space. Preference was given to projects with the following characteristics: emphasis on natural design, part of an ecosystem-based watershed management plan, emphasis on community involvement, demonstration of innovative restoration techniques, and pre- and post monitoring.

The purpose of monitoring is to identify and quantify techniques that enhance stream habitat and reduce erosion and sediment pollution. The methods and parameters vary from project to project and are based on the conditions and needs identified locally. There are 15 stream restoration projects approved for funding and ready for construction. These projects are located throughout the state. Eight county-sponsored projects are in Anne Arundel County, two each in Baltimore and Harford County Allegany, and one in Calvert County. Baltimore City is the local sponsor of one project, and in western Maryland, Allegany County Soil Conservation District is a local sponsor. Biological monitoring is currently underway at Biddison Run stream in Baltimore City. The monitoring consists of habitat assessment, fish sampling, macro-invertebrate sampling, water quality, and vegetation surveys.

Community Based Monitoring of the Restoration of Biddison Run
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ABSTRACT: In 2000, the Herring Run Watershed Association, Baltimore City, Baltimore County, and other local watershed associations and concerned citizens gathered for a charette to discuss the state of the urban waterways of the city. The resulting action from the charette identified Biddison Run as a prime restoration target for funding under TEA-21.

Biddison Run flows through the closed Bowleys Lane Landfill. High flows generated by the highly urbanized watershed have cause the stream to channelize and erode the slopes of the landfill, leading to the transporting of trash, sediment, and landfill leachate to Herring Run. In addition, the mouth of Biddison Run has gabions that block fish passage upstream from Herring Run. In order to evaluate the restoration of Biddison Run, the City of Baltimore has hired a contractor to manage the restoration portion of the project, while HRWA, using established EPA protocols, will monitor the instream conditions of Biddison Run.

This poster examines how HRWA is using volunteers to monitor the biological, chemical, and physical habitat of Biddison Run. This data will be used to judge the success of the restoration project. Since construction of the restoration project has not begun, effectiveness of the project will be based on improvements to the physical habitat, biological communities, and water quality at the two sites. The effectiveness of the riparian planting will be assessed by MD DNR. Monitoring will continue in 2004 once construction is complete. This project will help the City- ESD and HRWA, hone our ability to monitor and evaluate stream restoration projects while building capacity for members of HRWA to understand and participate in watershed planning and restoration efforts.

Watts Branch Watershed and Stream Assessment, Washington D.C.

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ABSTRACT: The U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (Service) and the District of Columbia, Department of Health (DOH), Watershed Protection Division have formed a partnership to restore stream systems within Washington D.C. As part of this partnership, the Service completed a fluvial geomorphic-based watershed and stream assessment of Watts Branch in September 2002. The project objectives were to: 1) determine the relationship between watershed landscape activities and stream processes; 2) characterize physical conditions of the stream; 3) identify watershed and instream conditions impacting the stream and riparian habitat; and 4) target and prioritize watershed and stream conditions for restoration or enhancement.

The survey results showed that the effects of land cover and land use activities on stream stability and habitat conditions in Watts Branch are typical of most urban watersheds. The large amounts of impervious surface in the Watts Branch watershed cause high stormwater runoff, high peak stream discharges, high flow velocities, flashy flows, low groundwater recharge, low base flows, poor water quality, high stream instability, poor instream habitat, and variations in sediment production. Furthermore, stream instability and poor instream habitat is aggravated by an extensive number of stormwater outfalls (41), several exposed utility crossings (7), sewer line leaks, and narrow to non-existent riparian buffers. Essentially 100 percent of Watt's Branch has been channelized or altered. The upstream reaches are entrenched and confined and have lost access to their floodplains due to fill and/or channel capacity enlargement from erosion. The downstream reaches are aggrading due to an increased sediment supply, a likely result of upstream stream instability problems.

The Service used a variety of criteria to identify and prioritize stream stability and the relative severity of the instability. Criteria included channel shear stress, bank erodibility, width/depth ratio, stream entrenchment, and incision. The Service also considered stream sensitivity characteristics based on management interpretations of various stream types presented in Rosgen(1996), including disturbance sensitivity, recovery potential, bank erosion potential, and sediment potential. Because of the severe impairment throughout Watts Branch, the Service rated all of Watts Branch as high restoration priority. The Service also identified and prioritized restoration opportunities within the watershed primarily based on outfalls and their drainage areas and land uses.

The report recommends using a natural channel design approach to restore the degraded reaches of Watts Branch; repair sewer lines; reduce runoff; repair and relocate utility lines and outfalls; and establish and/or expand riparian buffers. There are several options available for restoring Watts Branch. They range from reestablishing the stream on a historic floodplain to stabilizing the stream in place. There are associated advantages and disadvantages for each option. A multi-agency group, which includes the Service, DOH, and Corps of Engineers will select the preferred alternative during the next phase - design phase.

River Restoration in our Nation: A Scientific Synthesis to Improve Results

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ABSTRACT: A great deal of money and effort is expended today in stream restoration, yet too little energy has been directed toward learning what works and what does not, and how to make projects more effective in restoring river health. Given the urgent concerns over the health of our waterways, the timing is right for a rigorous scientific evaluation of our progress. The National Riverine Restoration Science Synthesis working group was formed to collect and synthesize information about stream restoration activities around the country; assess the state of both the science and the practice of river restoration; identify and communicate success stories; and make specific recommendations for improvements. The conservation of freshwater ecosystems in North America requires not only the protection of the best remaining locations, but also the managed recovery of altered and degraded ecosystems. Within areas of substantial human activity, even the aquatic ecosystems of highest value and quality experience significant stress from human actions. These systems will require some degree of management, which will benefit from a more mature science of restoration ecology.

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Coupling Science with Outreach: Maryland's Stream Waders Program

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ABSTRACT: The Department of Natural Resources (DNR) is Maryland's lead agency in the multi-jurisdictional Chesapeake Bay Restoration Program. One important commitment of the Bay Program is to work with local governments, community groups, and watershed organizations to develop and implement watershed management plans to deal with nonpoint source pollution throughout the 64,000 square mile watershed. Achieving this commitment in Maryland will require sound science in the form of monitoring data from the state's 15,000+ miles of streams, plus a knowledgeable citizenry willing to change their behavior to protect the state's watersheds.

To help DNR monitor and educate, a statewide volunteer monitoring program called Stream Waders was started in 2000, with more than 200 volunteers sampling over 700 sites. Since then, a total of 611volunteers have sampled 2100 sites for DNR, and have significantly contributed to the growing

information base on the health of Maryland's streams. Each volunteer attends an intensive day-long training session in basic stream ecology and assessment methods using benthic macroinvertebrate collections. Volunteers then commit to spending 2-3 days sampling up to 20 stream sites during March and April. Samples collected by the volunteers are processed by DNR staff, identified to the family taxonomic level, and counted. The results are used to supplement annual assessments of stream health completed by DNR.

More than ten local governments, over 40 volunteer organizations, and teachers from K-12 schools throughout Maryland had participated in the Stream Waders Program. Volunteers have received the program with enthusiasm. We have learned that participation in Stream Waders has heightened their awareness and knowledge of the health of Maryland's streams. Many volunteers have been inspired to increase their involvement in watershed protection.

James Island Habitat Restoration and Assessment of Existing Environmental Conditions
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ABSTRACT: James Island is located in Dorchester County, Maryland at the mouth of the Little Choptank River in the Chesapeake Bay. James Island and surrounding waters were investigated over four seasons to assess the existing terrestrial and aquatic resources present in and around the James Island remnants and monitor seasonal changes. Historic and current mapping of the island have indicated that over 800 acres of the island has eroded since 1847; the island currently consists of three remnants and is less than 100 acres in size. The erosion of Bay islands as a result of mean sea level rise is thought to be a natural process and a result of glacial melt that may or may not be a natural trend or due to global warming. It has been estimated that if nothing is done to prevent the current erosion of the Bay islands, they will disappear in the next 100 years.

Data were collected to support assessment and feasibility-level studies of James Island as a potential island habitat restoration project using dredged material. Specifically, James Island is currently being considered for an island restoration project that includes both wetland and upland cells using 40 to 80 million cubic yards of suitable dredged material. Currently, five potential dike alignments are being considered at this phase of study. The alignments range in size from 979 to 2,202 acres and all lie predominantly west of the remnants of James Island. The results from site assessment efforts of the sampling for feasibility-level evaluations from Fall 2001 to Summer 2002 are presented. Components of the investigation included an analysis of the benthic community, in situ water quality, fisheries studies, plankton collections, wildlife and avian observations, terrestrial and submerged aquatic vegetation mapping. This study was conducted by EA Engineering, Science, and Technology, Inc.(EA) for the Maryland Port Administration (MPA) under contract to Maryland Environmental Service (MES).

Interpretation of the Fluvial Geomorphic Response of Streams to Developing Watersheds

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ABSTRACT: Howard County is on its third year of an ongoing monitoring program to characterize the instream response that results when a watershed of forest and cropland is converted to residential development that employs stormwater best management practices designed in accord with Maryland's 2000 Stormwater Design Manual. Chemical, physical and biological responses are being monitored. This poster will present the preliminary findings primarily of the physical response and provides a monitoring and analysis approach to better interpret the fluvial geomorphic response to the land use changes. The approach describes the fluvial geomorphic response that would be anticipated from the pre-developed land use and provides benchmarks that can be used to assess whether construction practices and implemented stormwater best management practices are adequately protecting the stream from adverse physical impacts. This approach permits the evaluator to step back from rare and extreme weather events that can create significant one-time changes to stream geomorphology; rather the approach favors a trend analysis, which better comports with the actual response mechanisms of a stream system.

From Drought in 2002 to Recovery and Flooding in 2003

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ABSTRACT: In 2002, the Mid-Atlantic region experienced one of the worse droughts in history; however, above normal precipitation during the summer of 2003 led to a full recovery that ultimately led to flooding and very high water levels. The U.S. Geological Survey (USGS), which has many monitoring systems in wells and streams in Maryland, was in an ideal position to record the record levels during these extreme hydrologic periods.

During the drought period in 2002, most of the ground-water levels were below normal. Out of a total of 16 wells located within the region, six reached their lowest June levels in more than 40 years; exceeding the low water level records set during the drought of the 1960s. Several months of abundant rainfall in 2003 led to a full recovery from the drought and by June, all the USGS wells in the region had levels that were above normal. Specifically, six of the wells in the region were at their highest June levels in 40 years.

Flow to the Chesapeake Bay also went from near record lows in 2002 to near record highs in 2003. With streamflow and groundwater levels already high, tropical storm Isabel engulfed the Mid-Atlantic region on September 19, 2003 and precipitation associated with the storm raised groundwater and stream flow levels even higher. The increase in water levels, caused an inundation of the low-lying areas along the shores of the Chesapeake Bay, including Baltimore's Inner Harbor. Additional inches of rain on September 22-23 resulted in flooding in several Maryland streams and a near record high total flow into the Chesapeake Bay for September. Long-term data collected in the region will show that never

before have such extreme changes in water levels been experienced during a short period of time.

Aquatic Benthic Macroinvertebrates as Indicators of the Health of a Coastal Plain Stream

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ABSTRACT: The recent failing water quality grades the Chesapeake Bay received has alarmed us all. Water in the Bay comes from many sources, however the Patuxent River is a large contributor and influences the Bay's water quality. The Patuxent River's flow, in turn, originates in smaller streams, one of them being Two Run Creek, a Coastal Plain nontidal stream located within the Jug Bay Wetlands Sanctuary in Lothian, Maryland. Since 1996, volunteers, under the direction of a staff naturalist, have collected benthic macroinvertebrates, which they have sorted, identified, and counted in order to assess overall stream health. Samples were collected in D-nets using a method based on the Maryland Biological Stream Survey's Stream Waders program. Twenty representative samples of five microhabitats were taken within the 75-meter reach of the Creek quarterly, in January, May, July, and September. Three metrics of biological integrity were evaluated: *Taxonomic Richness*; *Number of Ephemeroptera*, *Plecoptera*, and *Trichoptera (EPT) families*; and *Percent Ephemeroptera*. Scores were ranked as Good, Fair, or Poor, based on statistics developed by the Maryland Department of Natural Resources. All but one of our twenty samples rated either "Fair" or "Good" in terms of *Taxonomic Richness*. Using the *Number of EPT*, Two Run Creek rated as "Fair" or "Good" in 70% of our samples. Four of the six "Poor" samples occurred during the summer. If we removed summer data, we found that 88 percent of the samples rate "Fair" or "Good." Based on *Percent Ephemeroptera*, the Creek rated "Fair" to "Good" in 95 percent of the samples. Noticeable seasonal and yearly variations occurred in the data. As with all of the research projects at Jug Bay Wetlands Sanctuary, ecological monitoring was only one facet of the study. Just as important, this research provided an opportunity for the public to become citizen scientists and to learn about natural science.

Will *Crassostrea virginica* Thrive in the Magothy River? A Study of Oyster Gardens in a Mesohaline Chesapeake Bay Tributary

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ABSTRACT: The purpose of this study was to determine the survivability and growth rate of oysters from spat set through their first year. As part of the Chesapeake Bay Foundation's Oyster Gardening Program, gardeners received two bags of spat on shell (approx. 200 shells per bag), which had been spawned at the Horn Point Laboratory Oyster Hatchery in Cambridge, MD.   Eighteen oyster gardens, consisting of four oyster cages that volunteers built at a CBF-sponsored workshop, were monitored within the Magothy River watershed. Sites were visited three times: in December 2002, in April and in May 2003.   The shell length of a subset of oysters was measured at each site and water quality data

(Secchi Disk depth, temperature, salinity, dissolved oxygen, dissolved oxygen percent saturation) were collected.   While growth rates were variable and water quality parameters were not predictive of growth rate and mortality, overall viability of oysters was good. Out of the oysters sampled at 17 sites, 9 sites had greater than 70 percent survival. Of those 9 sites, 7 had survival above 90 percent. Growth rates varied from negligible to 0.19 mm/day during the five-month monitoring period. This study will continue in 2003 as gardeners receive newly spawned oysters. Also included in the study will be spat from native Magothy oysters.

Monitoring Antimicrobial Compounds as Indicators of Sewerage Problems Impacting Urban Streams
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ABSTRACT: To gain an understanding of changing watershed conditions, the Howard County Stormwater Management Division (SWMD) finalized a plan designed to monitor all 15 of its subwatersheds over a five-year period. The primary goal of the program is to assess the current biological condition of Howard County streams and watersheds, as well as to establish a baseline for comparing future assessments. The county wants to be able to detect a 30 percent change in watershed condition 80 percent of the time, with a 95 percent confidence level.

The network design and site selection are based on a 1:100,000 map scale, allowing the county to be in agreement with the design of the statewide Maryland Biological Stream Survey (MBSS). Over a three-year period, several indicators (benthic macroinvertebrates, fish, physical habitat quality, sediment particle size distribution, and channel morphology) were sampled at over 150 stream locations throughout Howard County, using MBSS and modified U.S. EPA Rapid Bioassessment Protocol (RBP) methods. Duplicate samples were taken at 10 percent of the sites to address measurement error.

Cumulatively, in the first two years, over 300 different genera of benthic macroinvertebrates have been found, including a possible new species of tubificid worm (Oligochaeta: Tubificidae). Using the MBSS Benthic Index of Biological Integrity (B-IBI; based on a 5-point scale), mean biological condition (county-wide) was found to be in the "fair" range (3.10 ± 0.74, n = 90), with physical habitat quality rated as "non-supporting" (108.47 ± 7.31, 54 percent of maximum). These results represent the first cycle of county sampling.

Watershed-Based Biological Monitoring in Howard County, Maryland
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ABSTRACT: To gain an understanding of changing watershed conditions, the Howard County Stormwater Management Division (SWMD) finalized a plan designed to monitor all 15 of its subwatersheds over a five-year period. The primary goal of the program is to assess the current biological condition of Howard County

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Assessing Restoration Opportunities in Lower Bush Creek Watershed, Frederick County, Maryland

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ABSTRACT: The Lower Bush Creek Watershed in Frederick County, Maryland, is a relatively rural area that is experiencing rapid growth and development. Given the potential for urban watershed stresses to impact streams, Frederick County Division of Public Works sponsored a study to identify opportunities to improve and protect water quality and stream conditions. To identify the best sites for stream restoration and stormwater management (SWM) controls within the study area, Versar applied a multi-step restoration targeting approach. Existing background information were reviewed, including a 2001 watershed assessment, long-term stream monitoring data, maps, aerial photographs, and geographic information systems (GIS) data. Initial findings were used to focus field efforts downstream of developed areas. Teams conducted stream reconnaissance walks to identify degraded conditions indicative of upstream SWM problems and other stream restoration opportunities. Detailed data, site coordinates, and photographs were recorded. Further site visits were conducted to evaluate existing land uses, stormwater management structures, and drainage pathways to evaluate water pollution and hydraulic/hydrologic stressors. Major problem types included hydrologic modifications, erosion and channel destabilization, and nonpoint source pollution. Twenty-four candidate restoration sites were identified and ranked: six sites presented opportunities for both stream restoration and SWM controls; seventeen were candidates for stream restoration; and one site presented an opportunity for SWM maintenance.

Streamstats: A U.S. Geological Survey Web Site for Stream Information

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ABSTRACT: Estimates of streamflow statistics, such as the 100-year flood, the mean annual flow, and the 7-day, 10-year low flow are needed for design of bridges and other structures, for floodplain mapping, and for water-resources planning and management. The U.S. Geological Survey regularly publishes streamflow statistics for its data-collection stations, but estimates are often needed at locations where no data are available.

The U.S. Geological Survey (USGS) has developed a prototype Web application, named Streamstats, to provide simple methods for obtaining streamflow statistics and other information for gaged and ungaged streams in the United States. StreamStats users can click on gaging station locations in a map interface to obtain streamflow statistics and other information for the sites. Users can click on any point on a stream to obtain estimates of streamflow statistics and other information for the ungaged site. StreamStats sends the coordinates for the ungaged site to a server that runs a GIS, which determines the basin boundary for the site, measures various basin and/or climatic characteristics, and inserts the characteristics into regression equations to obtain estimates of streamflow statistics for the site. Streamstats also provides information on the reliability of the estimates.

Streamstats reduces the time needed to estimate streamflow statistics for ungaged sites from at least several hours to only a few minutes. It is currently only available for Idaho, but it is expected that several other states will be implemented within a year. StreamStats could rapidly be implemented for Maryland with support from local agencies.

The Clickable Map Concept: Status of the Data Management Committee's Efforts to Provide Metadata Through a Geographic Information System

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ABSTRACT: The Maryland Water Monitoring Council's (MWMC) Data Management Committee (DMC) has developed a GIS Web interface (Figure 1) to display planned water quality monitoring activities in the State. Development of the map is a cooperative endeavor between the Maryland Department of the Environment, which maintains the map, and the University of Maryland Baltimore County, which hosts and updates the Web site (located at http://www.cuereims.umbc.edu/MWMC). The original purpose of the map was to provide academia, volunteer monitoring groups, and resource managers from

all levels of government with the monitoring program metadata (e.g., station data, contact information) necessary to improve inter-program communication, coordination, partnering, and efficient use of aquatic monitoring resources in Maryland. Using information gathered from the MWMC's Monitoring and Assessment Committee's Stream Roundtable (Winter 2003), the DMC created an Internet Map Server (ArcIMS) to make this aquatic monitoring information readily available to any interested party having an Internet connection.

Having accomplished this initial goal, the DMC is discussing ideas for enhancing the current mapping interface through providing more comprehensive monitoring program data, providing watershed status and trends, allowing a querying capability, adding more data layers, and providing extensive links to other related sites. The DMC is currently revising the data request for the 2004 Stream Roundtable in order to acquire additional information for the next map update. The DMC hopes to receive broad input and suggestions from the water monitoring community on ways to make the MWMC's ArcIMS system a more useful tool to water monitoring groups and organizations across the State.
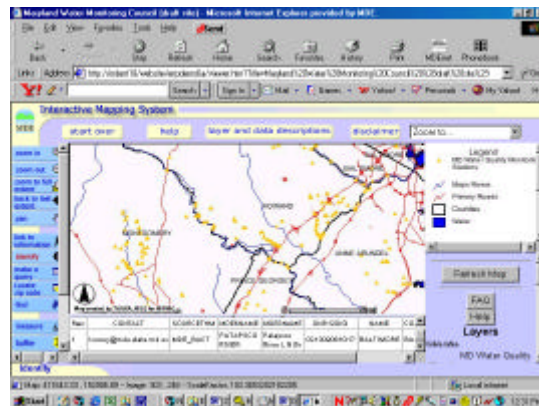

Figure 1: The MWMC's Internet Map Server

The Use of Impervious Cover in Rapid Watershed Planning
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ABSTRACT: Current and future impervious cover are important parameters to estimate in order to understand and effectively manage urban and suburban watersheds. Fairly simple and rapid methods are available to estimate impervious cover using Geographic Information Systems (GIS). By combining impervious cover estimates with existing water quality data, and additional field data, realistic restoration and protection goals can be set for individual subwatersheds of about 1-10 sq. miles. Impervious cover estimates provide an understanding of both current and likely future land use and biological conditions.

In Williamsburg Virginia, the Center for Watershed Protection combined impervious cover estimates, stakeholder involvement and field assessments to set goals for each of the 12 subwatersheds in the Powhatan Creek watershed. Subwatersheds that contained less than 10% impervious cover also contained

large tracts of contiguous forest, rare plant and animal species, and the high quality streams in the watershed. Impacted subwatersheds, with greater than 10% impervious cover, contained many actively incising streams with fair or poor habitat. These symptoms of degradation were particularly evident in the first order reaches where recent development has occurred.

Outcomes of the stakeholder process included recommendations for protection of the remaining sensitive subwatersheds, rehabilitation of impacted subwatersheds, and some redirection of future growth (ie. smart growth) into the already impacted subwatersheds. Specific recommendations to achieve those desired outcomes, along with estimated costs and responsibilities were set to help guide implementation and budgeting for the plan. Twenty of the twenty-four recommendations were adopted by the James City County Board of Supervisors by a vote of 6-0, with the four remaining recommendations set for additional study. Resources for implementation of the plan have been added to the County's capital budget, and plan implementation is currently underway.

Short-Term Impacts of Hurricane Isabel on Maryland's Chesapeake Bay Water Quality

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ABSTRACT: The Maryland Department of Natural Resources, Resource Assessment Service, conducted routine and special water quality sampling prior to and after Hurricane Isabel to assess the storm's impacts on Chesapeake Bay water quality. Data from a statewide network of 16 continuous water quality monitors collected dissolved oxygen, turbidity, chlorophyll, pH, water temperature and salinity data at 15-minute intervals throughout the period. Increases in salinity on the order of 1-7 ppt were observed during the hurricane-induced tidal surge, except in extreme upriver sites that saw decreases in salinity due to high freshwater flows. Most stations also observed large one-day spikes in turbidity immediately following the storm, and chlorophyll peaks five to six days afterwards, with resultant low dissolved oxygen.

Pre- and post-hurricane sampling was conducted at long-term fixed stations on the main-Bay and Potomac River, showing increases in salinity, decreases in water clarity and higher bottom dissolved oxygen levels as a result of water column mixing from winds and the tidal surge. Fixed station nutrient data is currently being analyzed in the laboratory, and may be available at the time of poster publication.

Spatially intensive water quality mapping data was collected on the Magothy and Middle Rivers immediately before and after Hurricane Isabel. The ephemeral turbidity events were not captured in the water quality mapping data, but high spatial resolution changes in salinity within these tributaries were documented.

Ecological Restoration of Urban Streams: Using Living Resources to Measure Success

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ABSTRACT: In February 1998, Montgomery County completed an assessment of biological, chemical, and habitat conditions covering most of the streams within county boundaries. The resulting Countywide Stream Protection Strategy (CSPS) evaluated stream conditions based upon aquatic life and stream channel habitat indicators. The CSPS has been recently updated to provide a comprehensive picture of stream conditions (Table 1), and, it documents the progress the County is making in addressing watershed management and restoration priorities originally identified in the first CSPS.

Table 1. 1994-2000 County Stream Conditions		
Stream Condition	**Stream Miles**	**Percent of Streams Monitored**
Excellent	84	7
Good	694	55
Fair	362	28
Poor	131	10
Total Monitored	1272	100

Stream erosion and sedimentation remain the dominant impacts on county streams. There are also isolated instances where other pollutant sources were a primary cause of biological impairment. The most severely impaired streams are generally found in older, "down-county" urban areas.

This poster examines how Montgomery County uses the results of watershed-based biological and habitat monitoring to identify areas for restoration, identify project goals, and to assess the success of completed projects. Hydrological and geomorphological data are essential to the planning and design of restoration projects. However, restoring conditions so that diverse communities of organisms can once again live in urban streams is the ultimate measure of restoration success for the county. Examples of restoration projects include Sligo Creek, Colesville Depot Tributary, Gum Springs Bypass, and the Northwest Branch at Old Randolph Road.